# REPORT OF DIABETIC SERVICE AT U. S. ARMY GENERAL HOSPITAL NO. 9, LAKEWOOD, NEW JERSEY.

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The special diabetic service which was in operation in this hospital from the end of July, 1918, to the end of May, 1919, was the only one of the kind in the American army and was intended to receive all diabetic cases developing in the more easterly districts of this country or returning from overseas. Owing to imperfect notification and other obstacles, by no means all such cases were actually assembled here, so that the statistical value of this report is limited. Of the total number of 40 cases received, 3 proved to be so-called "renal glycosuria" and have been reported elsewhere.[1] Three others (Nos. 8, 16 and 37 below) have also been described separately[2] [3] [4] because of certain special features. A summary of the observations concerning the entire 37 diabetic cases may be desirable as a record of military experience and for its instructiveness in some details.

Organization of Service. An old hotel had been taken over for the hospital and it was necessary to improvise everything for the diabetic as for other services. The barber shop was transformed into a chemical laboratory and a bedroom and adjoining bath on the ward were made into a diet kitchen. With a suitable chemical staff and equipment, experienced nurses and the cordial support of the commandant and other authorities it was proved that accurate and effective treatment could thus be carried out.

Study of Cases. The study was aided by the military requirement of a series of routine examinations and the coöperation of specialists in the various branches of medicine. The presence or absence of abnormalities was determined not only by general physical examination but also with the assistance of the eye, ear, nose and throat and dental, cardiac (including electrocardiographic), surgical, orthopedic, genito-urinary, radiographic, bacteriological and general laboratory services. The data obtainable have thus been increased in extent and value and the cordial helpfulness and absence of antagonism or intrigue also made this phase of the work a pleasure.

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[1] Allen, Wishart and Smith: Three Cases of "Renal Glycosuria." The Archives Int. Med., November 15, 1919.

[2] Mitchell: Amer. Jour. Med. Sc., May, 1919, p. 700, vol. clvii, 5.

[3] Allen and Mitchell: A Case of Hereditary Diabetes. Publication forthcoming.

[4] Allen and Mitchell: A Case of Uncontrollable Diabetes. Publication forthcoming.

| Case No. | Rank. | Age. | Race. | Civil occupation. | Family history. | Personal history. | | | | Physical examination. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Time elapsed. | | | Weight. | | | | | | | | |
| | | | | | | Diseases. | Military service years. | From first diabetic symptoms to the diagnosis. | From diagnosis to institution of dietotherapy. | Height. | Ordinary. | Admission. | Discharge. | Teeth. | Tonsils. | Lymph glands. | Viscera. | Nervous system. | Wassermann. |
| 1 | Capt. | 40 | Amer. | Physician | Father and one brother diabetic<br>Family obese | Mumps, measles and chicken-pox as a child | 4/12 not overseas | Few months | Immediately | 6 ft. 4 in. | 280 | 260 | 240 | Negative | Negative | Negative | Negative | Negative | Neg. |
| 2 | Capt. | 41 | Amer. | Post office employee | Maternal grandfather died of diabetes | Mumps, measles and scarlatina as child | 1 7/12 not overseas | Two months | Two weeks | 5 ft. 10 in. | 170 | 170 | 145 | Negative | Negative | Negative | Negative | Knee-jerks diminished | Neg. |
| 3 | Capt. | 55 | Amer. | Newspaper reporter | No diabetes or obesity | Mumps in childhood | 1 2/12 overseas. Shock and head injuries | Unknown | Unknown period of years | 5 ft. 10 in. | 210 | 180 | 145 | False | Negative | Palpable posterior cervicals | Liver palpable 2 cm. below costal margin | Knee-jerks increased | Blood ++ sp. fl. ++ |
| 4 | 2d Lt. | 37 | Amer. | Metal miner | Maternal relatives obese | Mumps, measles, whooping-cough and scarlatina as child. Typhoid at 10 yrs. Malaria at 22 yrs. | 3 5/12 not overseas | Two months | Immediately | 5 ft. 10 in. | 145 | 145 | 135 | Negative | Negative | Palpable posterior cervicals | Arteriosclerosis, early | Negative | Neg. |
| 5 | 1st Lt. | 34 | Amer. | Physician | Father died malignancy, 1 bro. of nephritis. No diabetes or obesity | Mumps, measles and chicken-pox in childhood | 1 4/12 overseas | Intermittent glycosuria for one month no other symptoms | One month | 5 ft. 8 in. | 200 | 215 | 153 | Negative | Negative | Negative | Scar of penetrating wound, left chest posterior | Negative | Neg. |
| 6 | Capt. | 45 | Eng. | Physician | No diabetes or obesity | Influenza, Sept. 18 | 1 3/12 overseas | One month | Three months | 5 ft. 5 in. | 145 | 137 | 126 | Pyorrhea and caries | Negative | Negative | Negative | Negative | Neg. |
| 7 | Capt. | 44 | Amer. | Soldier | Familial obesity | Measles and whooping-cough as child. Malaria in 1889; tropical liver 1906; influenza, Oct. '18 | 22 not overseas | One month | Four months | 5 ft. 11 in. | 225 | 180 | 155 | Negative | Negative | Negative | Heart enlarged to left. Liver palpable 5 cm. below costal margin | Knee-jerks absent Romberg positive. Sensation impaired lower extremities | Blood neg. sp. fl. neg. |
| 8 | Lieut. Naval | 43 | Canada | Marine eng. | No diabetes or obesity | Mumps and diphtheria in childhood | 1 8/12 torpedoed | 10 days | Immediately | 5 ft. 9 in. | 190 | 130 | 120 | Negative | Negative | Inguinal adenopathy | Liver palpable 3 cm. above umbilicus. Maximum ascites, bilateral hydrothorax | Knee-jerks absent | Neg. |

| Symptoms. | | | | | | Stay in hospital months. | Maintenance diet. | | | Faithful to diet. | Other treatment. | Plasma sugar under treatment. | Prognosis and reasons. | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Case No. | Glycosuria. | Acetonuria. | Plasma sugar % | Plasma $CO_2$ combining power vol. % | Clinical. | | Protein. | Carbohydrate. | Calories. | | | | | |
| 1 | Heavy | Negative | 0.356 | .... | Irritability; polyphagia, polydipsia, polyuria and loss of weight and strength | 2 | 100 | 125 | 3000 | Yes | None | 0.356–0.102 | Good. Age and training. | Obese type. |
| 2 | Heavy | Heavy | 0.400 | .... | Polyuria; polydipsia; xerostoma | 2 | 70 | 60 | 1800 | Fair | None | 0.400–0.100 | Fair. Age in patient's favor, but accidents are liable, as diabetes is not very seriously considered | |
| 3 | Faint | Faint | 0.250 | .... | Loquacious; slovenly; grandiose; no diabetic symptoms | 3 | 70 | 40 | 2000 | Fair | KI, mercury and salvarsan | 0.25 –0.09 | Bad. Early paresis | Patient states that glycosuria was present over a long period; could not remember exact date of discovery. |
| 4 | Moderate | Moderate | 0.200 | .... | Polydipsia; polyuria; polyphagia; failing vision | 1 | 70 | 50 | 1800 | Yes | None | 0.200–0.105 | Good. Age and intelligence | |
| 5 | Faint | Moderate | 0.129 | 59.5 | No symptoms. | 3 | 70 | 100 | 2000 | Yes | None | 0.129–0.106 | Good. Mild case; profession | Glucose tolerance (100 gm.) Dec. 16, 1918.<br>Plasma sugar, % · Urine, vol. c.c. · Urine, sugar, %<br>I. 0.090 · 16 · Neg. (fasting)<br>II. 0.250 · 75 · 3.33<br>III. 0.150 · 110 · 3.40<br>IV. 0.126 · 148 · 0.32 |
| 6 | Heavy | Faint | 0.18 | 55.5 | Nervousness; irritability; no classical symptoms | 3 | None | could be | prescribed | No | None | 0.15 –0.10 | Bad. Lack of intelligence and persistent slight hyperglycemia | Glucose tolerance (50 gm.) Jan. 17, 1919.<br>Plasma, sugar, % · Urine, vol. c.c. · Urine, sugar, %<br>I. 0.136 · ... · (Fasting)<br>II. 0.250<br>III. 0.273 · 38 · 0.50<br>IV. 0.250 · 135 · 0.25<br>V. 0.158 · 175 · Negative |
| 7 | Heavy | Faint | 0.356 | .... | Polyuria; polyphagia; polydipsia; loss of weight and strength; dizziness and incoördination | 3 | 80 | 80 | 2000 | Yes | Physiotherapy | 0.356–0.10 | Good. Age, type and fidelity | Obese type. |
| 8 | Heavy | Heavy | 0.450 | .... | Polyuria; polydipsia; polyphagia; loss of weight and strength; general anasarca; ascites and dyspnea | 9 | 70 | 10 | 1500 | No | Physiotherapy | 0.400–0.12 | Poor. Luetic cirrhosis and mental attitude | *Ascitic fluid gave two plus Wassermann Dec. 12, 1919. One week following provocative dose of salvarsan the blood Wassermann was one plus (army nomenclature). |

| Case No. | Rank. | Age. | Race. | Civil occupation. | Family history. | Personal history. | | | | Physical examination. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Diseases. | Military service years. | Time elapsed. | | Height. | Weight. | | | Teeth. | Tonsils. | Lymph glands. | Viscera. | Nervous system. | Wassermann. |
| | | | | | | | | From first diabetic symptoms to the diagnosis. | From diagnosis to institution of dietotherapy. | | Ordinary | Admission. | Discharge. | | | | | | |
| 9 | 2d Lt. | 25 | Amer. | Metallurgical engineering | No diabetes or obesity | Mumps, measles, scarlet and chicken-pox as child. Appendicitis, 1917, pus case | 1 5/12 overseas | One month | Two months | 5 ft. 6 in. | 140 | 130 | 120 | Negative | Negative | Negative | Negative | Negative | Neg. |
| 10 | Pvt. | 23 | Amer. | Clerk | One brother obese, no diabetes | Mumps and measles in childhood | 11/12 not overseas | Two months | Immediately | 5 ft. 6 in. | 130 | 102 | 100 | Negative | Negative | Cervicals palpable | Depression of old skull fracture | Negative | Neg. |
| 11 | Pvt. | 21 | Amer. | Laborer | No diabetes or obesity | Denies all diseases | 8/12 not overseas | Two months | Immediately | 5 ft. 9 in. | 150 | 138 | 130 | Negative | Chronic tonsillitis | Negative | Negative | Negative | Neg. |
| 12 | Corp. | 23 | Amer. | Teamster | No diabetes or obesity | Measles as child. Tonsillitis at onset of diabetes | 5 3/12 overseas | Two months | One and one-half months | 6 ft. 1 in. | 188 | 130 | 125 | Negative | Chronic tonsillitis (tonsillectomy) | General adenopathy | Negative | Knee-jerks diminished | Neg. |
| 13 | Cook | 28 | Amer. | Cook | No diabetes or obesity | Measles as child | 11/12 not overseas | At once | Two and one-half months | 5 ft. 10 in. | 154 | 119 | 115 | Negative | Negative | Negative | Negative | Rt. knee-jerk absent | Neg. |
| 14 | Sgt. | 41 | Amer. | Civil engineer | Father died following gall-bladder operation. No diabetes or obesity | Measles and scarlet fever as child. Furunculosis, 1915; influenza, Oct., 1918 | 1 not overseas | Three months | Six months | 5 ft. 8 in. | 175 | 152 | 135 | Negative | Negative | Negative | Negative | Knee-jerks diminished | Neg. |
| 15 | Pvt. | 22 | Amer. | Cotton mill worker | Father died apoplexy. 6 sisters and brothers died with diabetes | Mumps, measles, chicken-pox and smallpox as child. Rectal fistula in 1917, very chronic | 7/12 overseas | Existed prior to military service; discovered accidentally | Three months, army diagnosis. | 5 ft. 11 in. | 158 | 104 | ... | Caries | Chronic tonsillitis | General adenopathy | Entire left lung and right lower dull with crepitant rales. Fluid in right chest | Knee-jerks absent | Neg. |
| 16 | Ex-Sgt. | 32 | Amer. | Clerk | No diabetes or obesity | Measles, mumps and diphtheria as child. Frequent tonsillitis. Chancre, 1908 | 7 not overseas | One month | Immediately | 5 ft. 7 in. | 130 | 100 | 95 | Negative | Chronic tonsillitis | Negative | Negative | Knee-jerks diminished | Neg. |
| 17 | Pvt. | 19 | Amer. | Clerk | No diabetes or obesity | Measles and typhoid as child | 11/12 not overseas | Six months | Immediately | 5 ft. 8 in. | 160 | 130 | 122 | Negative | Chronic tonsillitis | Cervicals palpable | Negative | Knee-jerks diminished | Neg. |
| 18 | Pvt. | 30 | Dutch | Farmer | 3 brothers tuberculous. No diabetes or obesity | Measles as child | 5/12 not overseas | One month | Two months | 5 ft. 8 in. | 150 | 140 | 126 | Negative | Negative | Negative | Negative | Negative | Neg. |
| 19 | Pvt. | 21 | Amer. | Gunsmith | 3 aunts tuberculous. No diabetes or obesity | Denies all diseases | 2 not overseas | Five months | Immediately | 5 ft. 11 in. | 158 | 135 | 130 | Negative | Negative | Negative | Negative | Negative | Neg. |

|  | Symptoms. |  |  |  |  | Stay in hospital months. | Maintenance diet. |  |  | Faithful to diet. | Other treatment. | Plasma sugar under treatment. | Prognosis and reasons. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Glycosuria. | Acetonuria | Plasma sugar % | Plasma $CO_2$ combining power vol. % | Clinical. |  | Protein. | Carbohydrate. | Calories. |  |  |  |  |  |
| 9 | Moderate | Negative | 0.231 | 71.0 | Polyuria; polydipsia; loss of weight and strength | 3 | 75 | 100 | 2000 | Yes | None | 0.231–0.106 | Fair. Intelligent, but youthful type |  |
| 10 | Heavy | Moderate | 0.204 | .... | Polyuria; polydipsia; polyphagia; blurred vision; loss of weight and strength | 4 | 70 | 25 | 1200 | No | None | 0.220–0.106 | Poor. Lack of intelligence and poor environment |  |
| 11 | Heavy | Heavy | 0.490 | .... | Polyuria; polyphagia; insomnia | 6 | 70 | 25 | 1200 | No | None | 0.250–0.067 | Poor. Ignorance and lack of will power. |  |
| 12 | Heavy | Heavy | 0.345 | .... | Tonsillitis; polyuria; polyphagia; polydipsia; pruritus; loss of weight and strength | 5 | 70 | 80 | 2000 | Fair | Tonsillectomy | 0.500–0.064 | Doubtful on account of environment |  |
| 13 | Heavy | Heavy | 0.278 | .... | Lassitude and furunculosis | 3 | 60 | 10 | 1200 | No | None | 0.800–0.075 | Bad. Ignorance and weak will | Died (Feb. or March, 1919). |
| 14 | Heavy | Heavy | 0.378 | .... | Polyuria; polyphagia; polydipsia; loss of weight and strength | 5 | 70 | 60 | 1800 | No | None | 0.378–0.086 | Bad. Weak will and inherent severity of case |  |
| 15 | Heavy | Heavy | 0.800 | 23.0 | Polyuria; polydipsia; polyphagia; weakness; loss of weight; cough; chest pain | 5 | 70 | 50 to 0 | 1500–2000 | No | Fresh air | 0.800–0.125 | Bad. Advanced tuberculosis and severe diabetes | Died May 9, 1919. |
| 16 | Heavy | Heavy | 0.600 | 76.7 | Polyuria; polyphagia; polydipsia; loss of weight and strength | 3½ | 70 | 10 | 1200 | No | None | 0.25 –0.084 | Bad. Inherent severity of case and lack of will power | Blood Wassermann positive in 1908, negative 1911, two plus 1915 and negative in 1917. Spinal puncture negative in 1915. |
| 17 | Heavy | Heavy | 0.470 | .... | Polyuria; polydipsia; polyphagia; lassitude; dizziness | 4½ | 70 | 50 | 1800 | Yes | None | 0.210–0.09 | Good. Intelligent; good environment | Died March 2, 1919. |
| 18 | Heavy | Heavy | ... | .... | Polydipsia; polyuria | 4 | 70 | 50 | 1800 | Fair | None | 0.178–0.077 | Bad. Poor environment and ignorance |  |
| 19 | Heavy | Heavy | 0.400 | .... | Polyuria; polydipsia; loss of weight | 4 | 70 | 80 | 2000 | No | None | 0.500–0.095 | Bad. Untrustworthy |  |

| Case No. | Rank. | Age. | Race. | Civil occupation. | Family history. | Personal history. | | | | Physical examination. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Time elapsed. | | | Weight. | | | | | | | | |
| | | | | | | Diseases. | Military service years. | From first diabetic symptoms to the diagnosis. | From diagnosis to institution of dietotherapy. | Height. | Ordinary. | Admission. | Discharge. | Teeth. | Tonsils. | Lymph glands. | Viscera. | Nervous system. | Wassermann. |
| 20 | Corp. | 30 | Amer. | Cement contractor | No diabetes or obesity | Measles, chickenpox and whooping cough as child | 7/12 overseas | Two months | Two months | 5 ft. 8 in. | 146 | 127 | 125 | Negative | *Chronic tonsillitis* | Palpable cervical and inguinals | Negative | Knee-jerks diminished | Neg. |
| 21 | Pvt. | 20 | Amer. | Electrical engineering | Father died nephritis. Maternal uncle diabetic, obese type | Mumps and measles as child. Pneumonia in Dec., '17 and Oct., '18. Otitis media, bilateral, after onset of diabetes | 1 overseas | One week | Immediately | 5 ft. 10 in. | 150 | 95 | ... | Negative | Chronic tonsillitis | Negative | Otitis media, bilateral | Knee-jerks diminished | Neg. |
| 22 | Corp. | 24 | Polish | Chain maker | No diabetes or obesity | Tonsillitis at 21 | 1 1/12 overseas. Gas and shock | One month | Attempted at once; impossible in field hospital | 5 ft. 11 in. | 152 | 118 | 115 | Negative | Chronic tonsillitis | Palpable cervicals | Negative | Knee-jerks absent | One plus. |
| 23 | Pvt. | 22 | Negro | Farmer | No diabetes or obesity | Mumps and malaria as child. Respiratory infection preceding discovery of diabetes | 7 weeks not overseas | Two months | Immediately | 5 ft. 5 in. | 125 | 132 | 130 | Carious, 2 abscessed | Chronic tonsillitis | General adenopathy | Negative | Negative | Neg. |
| 24 | Pvt. | 28 | Negro | Laborer | Father, mother and only sister dead, cause unknown. Only brother tuberculous | Chills and fever every year | 7/12 overseas | Existed prior to military duty | Four months | 6 ft. 1 in. | 160 | 153 | 145 | Carious | Negative | General adenopathy | Negative | Negative | ++ |
| 25 | Pvt. | 24 | Jew | Printer | Mother died of diabetes. Cousin died of diabetes at 10 yrs. | Denies diseases of childhood. Never enjoyed good health, no stated reason | 5/12 overseas | Two weeks | One and one-half months | 5 ft. 10 in. | 155 | 115 | 107 | Carious | Chronic tonsillitis | Negative | Negative | Negative | Neg. |
| 26 | Pvt. | 25 | Amer. | Automechanic | Father died of heart condition. Mother is diabetic. Both grandmothers died of either nephritis or diabetes | Mumps, measles and whooping-cough as child | 11/12 overseas | No symptoms | Two months | 5 ft. 7 in. | 120 | 137 | 114 | Slight caries | Chronic tonsillitis | Negative | Negative | Negative | Neg. |

| Case No. | Symptoms. | | | | | Stay in hospital months. | Maintenance diet. | | | Faithful to diet. | Other treatment. | Plasma sugar under treatment. | Prognosis and reasons. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Glycosuria. | Acetonuria | Plasma sugar % | Plasma CO$_2$ combining power vol. % | Clinical. | | Protein. | Carbohydrate. | Calories. | | | | | |
| 0 | Heavy | Moderate | 0.240 | .... | Polyuria; polyphagia, polydipsia; loss of weight and strength | 4 | 80 | 80 | 2200 | Yes | None | 0.240–0.096 | Good. Reliable and intelligent | |
| 1 | Heavy | Heavy | 0.390 | 27.0 | Polyuria; polyphagia; polydipsia; failure to gain weight following influenza | 1 | .... | .... | .... | Yes | Ear irrigations and local applications | 0.300–0.132 | Poor. Infections present and severity of case | Died Jan. 16, 1919, of acute streptococcic meningitis secondary to otitis media. On day before death the plasma sugar was 0.195 per cent. and the CO$_2$ combining power 63.3 vol. per cent. |
| 2 | Heavy | Heavy | 0.312 | 57.6 | Polyuria; polyphagia; polydipsia; loss of weight and strength | 3½ | 100 | 100 | 1900 | Yes | None | 0.440–0.097 | Good. Intelligent and reliable | |
| 3 | Heavy | Slight | 0.25 | .... | Polyuria; polyphagia; polydipsia; weakness; pain in back | 3 | 75 | 75 | 2000 | No | None | 0.25 –0.095 | Bad. Ignorance and poor environment | Continuous acetonuria due to breaking diet. |
| 4 | Heavy | Faint | 0.696 | .... | Polyuria; "trench feet," with loss of distal phalanges of all toes (gangrene?) | 3 | 75 | 75 | 2000 | No | Mercury and salvarsan | 0.696–0.110 | Bad. Ignorance and poor environment | |
| 5 | Heavy | Heavy | 0.313 | .... | Polyuria; polyphagia; polydipsia; loss of weight and strength | 3 | 70 | 70 | 1800 | No | None | 0.454–0.122 | Bad. Ignorance and untrustworthiness | |
| 6 | Negative | Negative | 0.125 | .... | No symptoms | 4 | 70 | 100 | 1500 | Yes | None | 0.125–0.106 | Poor. Ignorance | An inherently mild case, but with continuous acetonuria. |

|  |  |  |  |  | Personal history. |  |  |  | Physical examination. |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rank. | Age. | Race. | Civil occupation. | Family history. | Diseases. | Military service years. | Time elapsed. |  | Height. | Weight. |  |  | Teeth. | Tonsils. | Lymph glands. | Viscera. | Nervous system. | Wassermann. |
|  |  |  |  |  |  |  | From first diabetic symptoms to the diagnosis. | From diagnosis to institution of dietotherapy. |  | Ordinary. | Admission. | Discharge. |  |  |  |  |  |  |
| Pvt. | 26 | Amer. | Machinist | No diabetes or obesity | Measles and chicken-pox as child | 1 7/12 overseas | One month | Two months | 5 ft. 6 in. | 135 | 97 | 98 | Negative | Negative | Negative | Pendulous abdomen. Dulness at left apex | Negative | Neg. |
| Pvt. | 27 | Amer. | Food chemist | No diabetes or obesity | Mumps, measles and chicken-pox as child. Pneumonia at 15 yrs. Jaundice in1916, 1917 and 1918 | 11/12 overseas | One week | Immediately | 5 ft. 5 in. | 126 | 126 | 120 | 2 abscessed | Negative | Palpable posterior cervicals | Slight epigastric tenderness. Spleen palpable | Negative | Neg. |
| Pvt. | 27 | Amer. | Clerk | No diabetes or obesity | Measles and typhoid as child | 7/12 overseas | Ten days | Immediately | 6 ft. | 150 | 146 | 131 | Caries | Negative | Negative | Negative | Knee-jerks diminished | Neg. |
| Corp. | 36 | Amer. | Steam fitter | No diabetes or obesity | Mumps, measles and chicken-pox as child | 6 9/12 not overseas | Five months | Immediately | 5 ft. 8 in. | 210 | 162 | 140 | Crowns and bridges, no abscesses | Chronic tonsillitis | Negative | Negative | Knee-jerks diminished | Neg. |
| Pvt. | 29 | Amer. | Railroad brakeman | No diabetes, mother obese | Mumps and typhoid as child | 1 1/12 overseas. Fractured 3 metatarsal bones | Two months | Immediately, but high diets caused persistent glycosuria. | 6 ft. 1 in. | 185 | 150 | 140 | Negative | Negative | General adenopathy | Negative | Neuritis of 11th right intercostal nerve | Neg. |
| Pvt. | 23 | Amer. | Teamster | No diabetes or obesity | Mumpsandpneumonia as child | 6/12 not overseas | Two weeks | Immediately | 5 ft. 10 in. | 160 | 149 | 138 | Negative | Chronic tonsillitis | Negative | Negative | Negative | Neg. |
| Pvt. | 27 | Irish | Machine work | No diabetes or obesity | Mumps and measles as child | 6/12 not overseas | One and one half months | Immediately | 5 ft. 5 in. | 140 | 112 | 110 | Caries, 2 abscessed | Chronic tonsillitis | Negative | Ptotic abdomen, bradycardia | Knee-jerks increased | Neg. |
| Corp. | 27 | Amer. | Foundry work. No lead | Maternalfamily obese. No diabetes | Measles as child. Scarlet 6 weeks prior to admission | 1 overseas | Fourmonths | Immediately; treatment broken by lack of facilities on transport | 5 ft. 10 in. | 145 | 140 | 130 | Negative | Negative | Palpable cervicals | Negative | Negative | Neg. |
| Pvt. | 28 | Jew | Printer | No diabetes or obesity | Measles as child | 6/12 not overseas | No symptoms; discovered in routine examination | Immediately | 5 ft. 5 in. | 115 | 100 | 100 | Negative | Negative | Negative | Negative | Negative | Neg. |
| Pvt. | 26 | Negro | Farmer | Father obese. No diabetes | Measles and malaria as child. Mumps Oct. 6, '18. Gonorrhea 9 yrs. ago | 10/12 not overseas | One month | Immediately | 5 ft. 7 in. | 142 | 137 | 130 | Negative | Chronic tonsillitis | Palpable cervical and epitrochlears | Negative | Negative | Neg. |
| Pvt. | 25 | Greek | Cook's helper | No diabetes or obesity | Denies all diseases | 11/12 not overseas | Existed prior to military duty, discovered two months after induction | Immediately | 5 ft. 10 in. | 140 | 110 | . . . | Extensive caries and pyorrhea | Chronic tonsillitis | Negative | Emaciation, dyspnea, very weak; no organic trouble found | Knee-jerks diminished | Neg. |

| Case No. | Symptoms. |  |  |  |  | Stay in hospital months. | Maintenance diet. |  |  | Faithful to diet. | Other treatment. | Plasma sugar under treatment. | Prognosis and reasons. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Glycosuria. | Acetonuria. | Plasma sugar % | Plasma $CO_2$ combining power vol. % | Clinical. |  | Protein. | Carbohydrate. | Calories. |  |  |  |  |  |
| 27 | Moderate | Negative | 0.192 | 63.3 | Polyuria; polyphagia; polydipsia; loss of weight and strength; ankle edema | 4 | 70 | 40 | 1500 | Yes | None | 0.192–0.09 | Bad. Latent tuberculosis and continuous acetonuria | *X*-ray corroborates physical finding at left apex. |
| 28 | Negative | Faint | 0.150 | .... | Polyuria; polyphagia; polydipsia; general malaise | 3 | 80 | 50 | 1400 | Yes | None | 0.15 –0.125 | Fair. Persistent acetonuria, requires further treatment | Patient failed to gain weight while convalescing from acute icterus following gas. |
| 29 | Faint | Negative | 0.117 | .... | Polyuria; polyphagia; polydipsia; loss of weight and strength | 2 | 70 | 40 | 1800 | Yes | None | 0.117–0.10 | Good. Intelligent and trustworthy |  |
| 30 | Heavy | Heavy | 0.375 | .... | Polyuria; polyphagia; polydipsia; loss of weight and strength | 4 | 80 | 10 | 1000 | No | None | 0.375–0.115 | Bad. Ignorant and untrustworthy |  |
| 31 | Heavy | Moderate | 0.400 | .... | Polyuria; polydipsia; polyphagia; loss of weight and strength | 2½ | 80 | 40 | 1500 | No | Physiotherapy | 0.400–0.105 | Bad. Ignorance and poor environment |  |
| 32 | Heavy | Faint | 0.221 | .... | Polyuria; polydipsia; polyphagia; slight loss of weight | 2 | 80 | 20 | 1200 | No | None | 0.325–0.100 | Bad. Ignorant and untrustworthy |  |
| 33 | Negative | Faint | 0.15 | .... | Polyuria; polydipsia; blurred vision; loss of weight and strength | 3 | 80 | 40 | 1200 | Yes | None | 0.154–0.09 | Fair. Ignorance may be overcome in institution | Electrocardiogram shows sinus bradycardia. Eye-grounds suggest beginning retinitis. |
| 34 | Moderate | Negative | 0.210 | .... | Polyuria; polyphagia; polydipsia; loss of weight and strength | 1 | 80 | 40 | 1500 | Yes | None | 0.210–0.11 | Fair. Intelligence and fair environment |  |
| 35 | Moderate | Faint | 0.147 | .... | No symptoms | 1 | 80 | 40 | 1500 | No | None | 0.147–0.11 | Poor. Ignorance extreme | Glucose tolerance (100 gm).<br>Plasma sugar, % — Urine, vol. c.c. — Urine sugar, %<br>I. 0.115 — ... — (Fasting)<br>II. 0.250<br>III. 0.326 — 16 — 0.45<br>IV. 0.272 — 76 — 0.70<br>V. 0.230 — 140 — Neg. |
| 36 | Moderate | Faint | 0.297 | .... | Polyuria; polyphagia; polydipsia; xerostoma | 1 | 80 | 40 | 1500 | Fair | None | 0.297–0.101 | Poor. Ignorance and racial characteristics |  |
| 37 | Heavy | Heavy | 0.475 | 35.0 | Polyuria; polyphagia; polydipsia; loss of weight and strength | 1 | .... | .... | .... | No | None | 0.56 –0.06 | Bad. Extreme diabetes | Died May 17, 1919. |

DISCIPLINE. At first thought a military hospital might be regarded as an ideal place for enforcing rules of diet. Among soldier patients, however, are represented all the usual causes of recalcitrance, such as ignorance, weak will, recklessness, hopelessness of their condition and inclination to end everything as quickly and comfortably as possible by eating to satiety, not only the same as in civilian patients, but also to a greater degree, because a number are included who in civil life would never undertake treatment at all. In addition there are special motives, notably the fact that the patients had no choice, but were sent to take a treatment under compulsion, the grievances already nourished by some against the military service or officers, the habits of enlisted men in grumbling at the quantity and quality of their food, and the natural spirit of sport among them while leading the idle hospital life to see how far they could go in individual or organized disobedience without being detected or punished. Appeal to military law was inadvisable for several reasons: with patients as shrewd and well united as the average soldiers conviction is difficult; the sudden occurrence of glycosuria under fixed conditions is excellent proof of transgression for hospital purposes but not before a military court; pleas that they only ate when forced by extreme hunger would win sympathy and light punishment or none for the offenders; treatment in the guardhouse was impossible unless with solitary confinement; and most important of all, the contention and hostility thus created between patients and officers would ruin the purposes of the service. Accordingly, no patient was subjected to any attempt at arrest or trial, but discipline was maintained by cultivating their knowledge and self-control. They were supplied with the best books and encouraged to find out anything they could through independent reading and inquiries in order to convince them of the seriousness of diabetes and the necessity of dietetic treatment; and at first they were allowed full liberty of movement. When they unanimously and flagrantly broke diet they were confined first to the ward and later to their rooms, not by military guards but by attendants, as in a civilian hospital. Against stealthier violations of diet with protein and fat, substitutions of urine and other familiar tricks, the rule was maintained that blood as well as urine must be constantly normal. Fortunately the first patients had not the severest diabetes, and it was possible to prove to them in confinement that they could be free from hyperglycemia and acidosis on satisfying and appetizing diets. By having the blood-sugar taken at unexpected times they quickly learned that this was a test which they could not cheat or evade. Essentially through the fact that the blood-sugar level decided between food and freedom on the one hand and fasting and confinement on the other, the initial spirit of rebellion died out in about two weeks so completely that it never revived. Thereafter only sporadic individual lapses had to be dealt with, and the general fidelity was able to meet the two crucial tests of the *esprit du corps* of a diabetic department. One of these is that every patient, without exception, at discharge had feelings of gratitude and the determination (varying with his strength of will) to continue his diet and remain sugar-free outside the hospital. The other is that the patients in the hospital were mutually helpful; the newcomers acquired from the older ones confidence, obedience and knowledge of food values, so that a minimum of instruction or discipline was necessary.

ETIOLOGY. The possible causative influences may be considered under the following headings:

HEREDITY. The record of six patients with diabetic relatives out of a total of thirty-seven is probably higher than would be generally found in an equal number of non-diabetic cases and tends to confirm the existence of a hereditary element, especially if it be conceded that some instances were probably missed on account of the ignorance of many of the patients concerning their family history. The family incidence of obesity, tuberculosis and neoplasms is probably rather high, though exact reckoning is unprofitable for the above reason. The remarkable hereditary features of Case No. 15 furnished the subject of one of the special papers referred to previously.[3]

RACE. The proportion of two Jews and three Negroes was unusual. More of the former and fewer of the latter would naturally have been expected. The relation may have been accidental and the statistics for the entire army may be very different. Otherwise nothing special was noticed in the racial incidence.

CHARACTER AND CONSTITUTION. Patient No. 37 was mentally inferior.[4] The others were fully up to the average of soldiers mentally and physically, and, on the whole, were of an excellent type in both respects. The experience tends to discredit the idea of general constitutional defects in diabetics.

DIET. Neither excess in carbohydrate nor general gluttony was apparently more prominent in these patients than among the average population, and there was no evidence of diet as a primary cause in any case. If patient No. 1 had eaten less the development of his diabetes would presumably have been delayed or perhaps prevented, according to the known rules of treatment, and the same may be true of the others in proportion to their obesity and habits. In the majority of the series overeating was not evident even as an exciting cause, and the proportion of thin and abstemious patients equalled or exceeded that of fat and gluttonous patients. In general, such observations will perhaps hold more strongly for young persons than for the more elderly type of diabetics.

NERVOUS CAUSES. No soldier in this series was markedly neurotic and the great majority were strong and well poised, sometimes phlegmatic. The high proportion of nine officers to twenty-eight enlisted men is probably artificial, because the urine of officers was examined more often, and they were more likely to come for special treatment. Thus, one of the officers was not from the army but from the navy, and some of the others had made special efforts to be transferred to Lakewood. The greatest advantage of such a service in regard to the theory of the subject lay in the opportunity of observing possible cases of diabetes following physical or psychic shock, strain or injury. Only one case was encountered in which the onset of glycosuria seemed, with considerable probability, to date from a tremendous shock, and this proved to be renal glycosuria. Patient No. 22 was gassed with mustard and chlorin and a few hours later suffered concussion from a high-explosive shell. He was sent to a field hospital on account of "nervousness and excitement" and thence to a rest camp, in which clinical symptoms of diabetes were noticeable for the first time and the diagnosis was made by urinalysis a few weeks later. The most probable assumption is that a diabetic predisposition existed in such a case, and the lack of prior urinalyses prevents decision whether the shock came before or after the beginning of the glycosuria and concerning its role in the causation. Two other patients had histories somewhat like this one. No. 8, the naval officer, was on a torpedoed vessel and suffered from anxiety and exposure, though not wounded. No 3, a captain of artillery, sustained head injuries in a motorcycle collision at the front, and a month later was blown up by the explosion of an ammunition dump from which he was trying to rescue a wounded comrade. Glycosuria and other diabetic symptoms followed in each case, but it happens that in each of these the existence of diabetes was known before the injury. Even an aggravating influence of the shock is not established, for in the former instance the improper diet on reaching port sufficiently explained the outbreak of symptoms, and in the latter case the diabetes remained mild, as it had been before. Wounded or sick soldiers were the ones most often subjected to urinalysis, and it was therefore natural that the diagnosis should often be made at such a time. Thus, patient No. 31 fractured three metatarsal bones during debarcation in France, and diabetic symptoms and glycosuria were noticed shortly thereafter. On the other hand the rarity of glycosuria after injuries is the striking lesson of the war. Also a large number of glucose tolerance tests performed by various medical officers for various purposes upon men returning from overseas suffering or convalescent from medical or surgical conditions have shown no special diabetic tendencies. If such tendencies were created in any marked degree by any form of injury, shock, strain or suffering, it must inevitably have been revealed by the observations on a wholesale scale in the different armies and even the civil populations. The war has been in this respect an immense experiment on human beings, establishing firmly some conclusions which could scarcely have been settled by animal experimentation. While nervous influences are not excluded as affecting diabetes when the disease or predisposition is present, the main contribution of the war to this subject is the fact that the epidemic of diabetes which was to be expected on the nervous hypothesis of the etiology did not occur, and consequently this hypothesis, as concerns the primary cause of the disease, is decisively overthrown.

SYPHILIS. This infection was demonstrated in 4 of the 37 cases. Patient No. 3 had a definite history, strongly positive Wassermann reactions in blood and spinal fluid and early paresis. No. 8 had first a negative Wassermann in the blood, later a one plus after a provocative dose of salvarsan, a two plus (army nomenclature) in the ascitic fluid and a cirrhosis of the liver which responded markedly to specific treatment. No. 16 had a history of a chancre in 1908 and double plus Wassermann tests in the blood in that year and 1915. His diabetes was discovered following circumcision in 1915 and progressed downward notwithstanding military treatment, which made his blood Wassermann negative, the test being also found negative in the spinal fluid. No. 23, a Negro, had a history only of gonorrhea and no symptoms or signs except a two-plus Wassermann reaction. No. 22 was reported to have a one-plus blood test, but the negative findings in all other respects were accepted as excluding syphilis. Careful examinations gave no grounds for suspicion in the other 32 cases.

OTHER INFECTIONS. Matters as trivial as an occasional small cavity in a tooth are omitted from the table. The dental service found small root abscesses in 6 cases. The extremely bad teeth of patient No. 37 may have had etiological importance.[4] The 17 cases of chronic tonsillitis tabulated are mostly technical diagnoses, which did not cause the throat department to advise tonsillectomy and can scarcely serve to incriminate the tonsils. The personal histories of the patients, as a whole, included about the usual list of miscellaneous infections. In 7 cases suspicious events antedating the diabetes were elicited as follows: No. 7 had malaria and "tropical liver" in 1906, and the liver is still enlarged; diabetes was discovered in September, 1918, and became worse with influenza the following month. No. 9 had appendicitis with peritonitis and operation in April, 1917, passed examination (with urinalysis) for commission in November, and the first symptoms and diagnosis of diabetes occurred in May, 1918. No. 12 contracted acute tonsillitis at the front in May, 1918, and diabetes followed immediately. No. 14 had "grippe" in October, 1917, followed immediately by diabetic symptoms. No. 21 had influenza and pneumonia, followed immediately by diabetic symptoms. No. 23 (Negro) likewise had a respiratory infection, returned to duty after two weeks, felt weak and after seven weeks was forced to enter the hospital, where diabetes was diagnosed. No. 28 had pneumonia at fifteen and several attacks of jaundice since. In October, 1918, he inhaled a little mustard gas and immediately developed jaundice, clay-colored stools and tenderness in the gall-bladder region, followed within two weeks by diabetes. Such histories are very suggestive, especially in view of their number; but the same care must be used as in the judgment of trauma and shock, and these cases can never be fully conclusive for the same reasons. In several cases of this series, dental caries and pyorrhea, boils, influenza and other infections are known to have followed the onset of diabetes, in conformity with the familiar lowering of resistance in this disease; and in case No. 34 the history of scarlet fever six weeks before admission seemed significant until it was found that the diabetes was of four months' duration. Also the above-mentioned fact that the sick most often have their urine examined, and the aggravation of an existing diabetes which is known to result from infection may likewise serve to explain the observations of both glycosuria and other symptoms under these conditions. The decision is governed chiefly by pathological evidence[5] that the origin of diabetes is regularly in an infectious pancreatitis. Infections of the above character thus acquire significance as the causes of such pancreatitis, and also syphilis, which is known to cause pancreatitis, is easily understood as a cause of diabetes in certain cases. The combination of the above 7 cases and the 4 luetic cases makes a high proportion of cases in which the infectious origin is directly suggested. It so happened that in Case No. 21 the assumed pancreatitis could be verified by autopsy, and the same pathological basis was also found in the two other cases which came to autopsy. It may therefore be concluded that the origin of military and civil diabetes is the same.

Type of Cases. There was some expectation that soldiers would furnish a selected group of cases of recent onset in young persons. The severe type characteristic of the young did in fact predominate, but the chance to treat such cases in their earliest and most hopeful stage was seldom obtained. Some diabetics were accepted in the draft and in others the diagnosis and treatment were delayed surprisingly long, as shown in columns 9 and 10 of the table. On the whole the cases were about the same as an average group at similar ages in civil life. Stated otherwise, this means that doctors overlook diabetes to about the same extent in military and in civil practice, and that in general the lack of early diagnosis is the greatest obstacle to the attainment of the best therapeutic results.

Treatment. All discoverable abnormalities were treated as in normal persons; carious teeth were filled or extracted; arsphenamin, mercury and iodides were used in the luetic cases and tonsillectomy was performed in case No. 12, which began with tonsillitis. As usual a probable cause of downward progress was thus removed, but in no instance did the diabetes run a course different from the average thereafter. As permanent damage has generally been done in the pancreas it is unreasonable to expect a cure of diabetes by removal of the infectious cause. The diabetes was treated by initial fasting until glycosuria ceased, followed by a diet of protein and generally a little carbohydrate until hyperglycemia and acidosis were abolished. The diet was then built up, especially with fat, as shown under "maintenance diet" in the table, the allowance of all three classes of foods being governed by the severity of the case and normal blood-sugar and negative nitroprusside reactions being insisted upon throughout.

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[5] Rockefeller Institute monograph No. 11, 1919, Chapter VIII.

RESULTS. Mention should first be made of the 5 deaths, 3 in hospital and 2 outside. Patient No. 15 had advanced tuberculosis and acidosis at admission, improved temporarily and died after five months.[3] No. 21 entered with a middle-ear abscess and died of meningitis before the diabetes was thoroughly under control. No. 37 was an extraordinary case in which the diabetes could not be controlled by fasting.[4] Patient No. 13 was a hopelessly weak-willed individual who improved during three months in hospital but required confinement most of the time; he was discharged into bad environment, made a brief attempt to continue diet, then ate at will and died within three months. No. 17 had inherently very severe diabetes, but in conduct was one of the best in the series; after four and one-half months in hospital, during which he was in excellent condition, he was discharged with a good prognosis and died within two months. The danger lay in allowing such a patient to live far away from the supervision of any specialist. The terminal symptoms of nausea and collapse suggest fasting acidosis, and the boy possibly overstepped his diet unintentionally and encountered disaster when he tried to check symptoms by fasting.

RESULTS CONCERNING COMPLICATIONS. The fatal ending of tuberculosis and middle-ear abscess was mentioned above. Otherwise complications have ended favorably or failed to develop. Tonsillectomy was safely borne and every patient has responded to dental or surgical treatment like a normal person. During the extensive influenza epidemic it so happened that no diabetic patient acquired it, though they were equally exposed with other patients. The freedom from the traditional tormenting complications of diabetes is one of the principal benefits of thorough treatment, and the higher resistance to infection of the patient kept symptom-free by undernutrition as compared with the one who has active diabetes is a point to be emphasized.

RESULTS CONCERNING DIABETES. With the exceptions mentioned it was possible to attain freedom from hyperglycemia and acidosis in all cases and to maintain this freedom on a diet supporting the body weight at a level inversely proportional to the severity of the case. The few cases in which the table shows a "maintenance diet" of only 1000 to 1200 calories were some in which diet had been broken so that treatment was not complete at discharge, though they were not more severe than some others. It is recognized that in cases more severe than these the standard of treatment mentioned sometimes necessitates extreme emaciation and weakness if the attempt is to be made to prevent downward progress by keeping the diet strictly within the assimilative power. These distressing end-stages may be either prevented or postponed by application of the same principle in the earlier stages, and for this purpose it will be noted that the diet in even the mildest cases was fixed so as to maintain a reduced level of weight.

PROGNOSIS. Notwithstanding the general favorable progress in hospital the prognosis is recorded as unfavorable in a high proportion of the cases. It unfortunately is still unproved whether the best treatment by the present methods can succeed permanently in arresting the downward progress in severe cases. But when poorly educated patients must go out to make their living in unfavorable environment without proper supervision, the result can be easily foretold. Unsuccessful attempts were made to interest the Red Cross and other organizations in establishing some institution or colony for the after-care of such patients, whose fate is typical of the neglect of chronic disease among the poorer classes in most communities.

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## STUDIES IN BONE GROWTH: AN EXPERIMENTAL ATTEMPT TO PRODUCE PSEUDARTHROSIS.

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THE studies herewith presented, and others which will be published later, were made possible through the generosity of the Surgeon-General in permitting the addition of a well equipped animal research annex to the pathological laboratories at U. S. Army General Hospital No. 3, Colonia, N. J., thereby affording facilities for the continuation of investigations relative to bone growth and allied subjects.

In the early months of our participation in the War, during the preliminary organization of this hospital under the joint auspices of the Red Cross and the Surgeon-General's Office, the author, who had been designated as director of the hospital, was allowed to draw